

## Collection and storage of Expressed Breast Milk: Policy Analysis paper

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### ABSTRACT

Breast milk is the gold standard of nutrition even for healthy and unhealthy newborns. Infants who are hospitalized in NICUs are unable to be fed by their mothers. Thus, expressed breast milk (EBM) from their own mothers should be administered by the nurse in another way. Proper expression, collection, storage and collection of EBM should be considered because breast milk is a body fluid and have the probability for contamination, improper storage and administration. The purpose of this paper is to analyze the issue of breast milk collection and storage for hospitalized infants in the NICUs in Jordanian hospitals. Furthermore, the paper described the appropriate strategies to overcome improper collection, storage and administration of the EBM IN Jordanian hospitals. Eight step guides was used to analyze the issue. Rodriquez-Garcia (2002) five evaluation criteria were also used. After weighing the policy options for their relevancy, progression, impact, effectiveness and efficiency, the bar-coded system was the most appropriate option in order to overcome the improper collection, storage and administration of EBM in hospitalized infants. Policy makers, hospital administrators should consider this system in Jordanian hospital to assure optimal safety for their hospitalized infants.

**Keywords:** breast milk collection, storage of breast milk, Jordan, NICU, policy analysis, nurses

### 1. INTRODUCTION

Jordan is a small lower middle income country with limited natural resources. It is divided into 12 governorates. The total population is 11.1 million people. The average annual growth rate is 2.7 %, the average persons per family are 4.8 and the total fertility rate is 2.6%; these statistics are decreased comparing with the previous one except for the growth rate which was increased regarding the large flow of Syrian refugees into the country. It was documented that the infant mortality rate for the same year was 15.7 per1000 births and the total maternal mortality rate is 28 deaths per 100.000. Thus considerable progress was achieved in decreasing infants and child mortality rates as well as the maternal mortality rates. In addition to that, there was a noticeable progress in reducing critical health risks to infants and children; it was documented that the country achieved universal child immunization in 1988 and Jordan has been polio free since 1995 (Jordan Department of Statistics ,2022; World Health Organization, 2012).

The improvement in the health status in Jordanian population indicates the important efforts that had been taken to improve the health status for the population. On the other hand, the large number of Syrian refugees posing extreme burden on the health sector management and service delivery capacity as 85% of them are living outside the camps within Jordanian communities. Jordan's economic growth, fiscal health, and ability to provide basic services have all been affected, threatening to undermine the country's recent development progress (World Health Organization, 2019).

Jordan's health system composed of three major sectors: the public, private and donors; the public sector is consisting of the Ministry of health and the Royal medical services, which finance as well as deliver care. Additional to this there is a university based public programs; Jordan university hospital and King Abdulla hospital (World Health Organization, 2015). King Abdulla university hospital was established in 2002 by Jordan University of science and technology JUST. The total

bed capacity is 538 beds. The hospital is considered as a teaching hospital to the faculty of medicine at JUST and as a referral hospital for the all public sectors in the northern region (King Abdulla university hospital, 2010).

## 2. PROBLEM

Breast feeding is the preferable form of feeding for all infants, and it is recommended by the World Health Organization (WHO) to be fed exclusively to all infants for the first six months of their life (WHO, 2017). Breast milk has several proven benefits not only to the mothers and infants, but also to the economy and to the community as whole (Prentice, 2022., Vectora et al, 2017., Purdy& Melwak, 2013). This preference is due to its superiority over the synthetic formula in several characteristics such as probability of improving host defense, absorption of specific nutrients, its tolerance by infants and its significance participation of the neurological development of the infants (Purdy & Melwak, 2013). Furthermore, systematic review conducted by Vectora et al, 2016 supported that breast feeding can prevent 13% of infant mortality and reduce the sudden infant death syndrome by 36%. Moreover, breast feeding reduces the health complications and the cost of treating these complications for both mothers and their infants. This is evidenced by that breast feeding could prevent 823 000 annual deaths in children younger than 5 years and 20 000 annual deaths from breast cancer. Lactation also reduces the economic cost of synthetic formula and their bottles in addition to that it is safe and environmentally friendly (Brahm and Valdes, 2017).

In addition to its nutritional, economical, emotional and psychological advantages for both mothers and infants, it protects the infants against bacterial and viral infections in several ways (Prentice,2022). The components of breast milk are able to destroy disease-producing cells and fight infections.

Breast milk is not only recommended for healthy newborns, but also for the high risk infants (preterm infants, low birth weight, very low birth weight and infants with complex health needs) (Quitadamo et al, 2024). Very low birth weight, preterm infants and hospitalized infants in the neonate intensive care units (NICUs) are not able to be fed constantly from their mothers due to weak, immature, and/or irregular sucking, for that reasons, expressed breast milk from their own mothers have to be administered by nurses in these units in different way (Purdy & Melwak, 2013).

Because breast milk is a body fluid and has the potential for contamination and to be fed to another infant, proper handling and storage must be maintained. Many factors can lead to contamination and miss-delivery of the expressed breast milk (EBM) to wrong baby. These factors include improper expression of the milk, collection, storage, refrigeration, thawing, inadequate identification techniques, improper dispensing of the EBM (Gad et al,2021).

In Jordan, breast feeding practices have been changed over years because of many social factors such as (higher education and increase the percentage of female employees) (Khassawneh, Khader, Amarin & Alkafajei, 2006). The Jordanian demographic and health survey in 2002, documented that the percentage of babies (0-6) months who were exclusively fed with breast milk was 27%, and in 2007 was 38.7%, but in 2012, the percentage is declined to only 23% (Department of Statistics, 2012). Recent study conducted in Jordan in three northern governorates, demonstrated that only 1% of Jordanian mothers had exclusively breast fed their babies at the end of sixth months after giving birth as recommended by the health world organization (Abuldhal, AL-Modallal, Yousef & Almresi, 2013).

National data regarding nurses` practices in the NICUs is limited and not well validated. A recent study conducted in Jordan by Al-Osoufi et al, 2024 reported that the nursing staff in NICU have some challenges, including staff shortages and resource limitations. The study recommends increasing staffing levels and investing in additional resources to further improve nursing care practices for neonates in NICUs.

Another study conducted in Northern Jordan to assess the knowledge, practice and perceived barriers of NICU nurses regarding collecting and storing of expressed breast milk, the results revealed that the nurse`s knowledge and practice regarding EBM were adequate in general but there were knowledge gaps in some areas such as: discarding breast milk if the newborn is fasting for a long period of time, thawing process and storage temperature. The study revealed that the environmental factors that impede the expression of breast milk were: the NICUs were not well prepared for mothers to express and collect breast milk such as: small inappropriate room, absence of needed equipment and absence of appropriate instructions for mothers regarding milk expression. Furthermore, regarding the organizational factors that affect EBM, the study summarized the barriers that encounter NICU nurses in collecting and storing breast milk such as: absence of unit policy in some hospitals, inactive policy in other hospitals, work load and time constraints in addition to inappropriate milk room as an environmental factor ( Ghariabeh, Al-sheyab & Malkawi, 2016). Therefore, the purpose of this paper is to analyse the measures that can be taken by the stakeholders to assure the optimal safety when collecting and storing expressed breast milk.

## 3. BACKGROUND

It is recommended worldwide that all infants even who admitted to the neonatal Intensive Care Units (NICU) to receive breast milk due to its superiority over the synthetic milk formula in several characteristics (properties of improving host defense, absorption of specific nutrients, its tolerance by the infants, and its significant participation in the neurological

development of the infants) (Purdy & Melwak, 2013). Expressed Breast Milk (EBM) can be collected and fed to infants indirectly or via nasogastric tube (Biere et al, 2016). This section will provide background information regarding infections transmitted via breast milk, the effect of storage on expressed breast milk, storage and bacterial contamination and Effect of storage on the nutritional quality of EBM.

#### 4. INFECTIONS TRANSMITTED VIA BREAST MILK

Breast milk is not sterile and it can include infectious agents. It is well documented that *Staphylococcus aureus*, group streptococci, *Eschericia Coli*, *Pseudomonas spp*, *Klebsiella spp*, *Serratia spp*, *Salmonella spp*, human immunodeficiency virus (HIV) and cytomegalovirus are transmitted through breast milk. Bacteria isolated from EBM are considered a natural ingredient of the microbiota of breast milk rather than contamination. On the other hand, HIV is a serious infection and it is recommended that HIV mothers do not feed their infants with breast milk. Hepatitis B transmitted by fresh breast milk but their contagious prosperities now documented to be very low because of the newborn vaccination. While hepatitis C virus and herpes simplex virus found to be detected in breast milk, their transmission is very low unless the mother has active lesions, cracked or bleeding nipples. There are no recommendations against breast feeding from hepatitis C infected mothers unlike the recommendations of breast feeding avoidance until the herpes simplex lesions resolved. Human T cell leukemia (HTLV I & II) can be transmitted in breast milk and the infection is proportional with the period of breast feeding; the longer the period the higher the risk. Thus it is recommended to stop breast feeding till infection subsides. If the nipples involved with a syphilitic infection, then breast feeding or expressed milk must be avoided until the nipples healed (Gad et al, 2021).

#### 5. THE EFFECTS OF STORAGE ON EXPRESSED BREAST MILK

There are slight variations in the recommended temperature in which the expressed milk can be stored. (Slutzah, 2010) examined 36 fresh milk samples which were divided and stored at a temperature of four degrees for different periods of times (0, 24, 48, 72 and 96 hours). At each time he examined the PH, white cell count, and osmolality. Other samples were stored at -80 to be examined for bacteria and concentration of lactoferrin, secretory (S) IgA, fat, fatty acids, and proteins. The study concluded that the overall integrity of the fresh milk during the refrigerator storage was preserved and the EBM can be stored at refrigerator temperature for as long as 96 hours. From the other hand Smith, 2018 recommended that consideration of the actual refrigerator temperature must be monitored as they noticed in their study that despite the researchers set the refrigerator temperature to 5C, the mean temperature throughout the study was 6.8 C because of the frequent opening of the refrigerator. Jordan Ministry of health guidelines listed in this table (Jordan ministry of health, 2015).

**Table 1: MOH guidelines for the EBM storage.**

Method of Storage	Storage Time
Room temperature (18 to 22 C)	2-4 hour
Refrigerator (4C/39F)	48 hours
Freezer (0 to -10 C)	3 months (may be frozen for up to 6 months for use with healthy infants)

#### Effect of storage and bacterial contamination

When the EBM expressed carefully from the mother and away from any contamination, the bacteriological profile seemed to be the same after storage regardless of the way of storage or duration. Sax institute studied the effect of the container types used for milk collection and storage. They concluded that no significant difference between Pyrex bottles versus polyethylene bags, and between hard and soft polyethylene bags in terms of bacterial contamination (Rodrigo, Amer & Foster, 2018).

#### Effect of storage on the nutritional quality of EBM

Temperature control and duration of storage have effects on the nutritional quality of the EBM. It was reported by the Sax institute that the frozen EBM at -20 loses more antioxidants properties compared with frozen EBM at -80 C on short run storage but on the long term (between one to ten weeks) there was noticeable reduction in fat and carbohydrate content in EBM. Another study found that refrigerated EBM for up to 96 hours at a mean temperature of 6.8 C has no adverse effect on lipid, fatty acid composition and oxidative status of EBM.

#### Stakeholders analysis:

Stakeholders involved in the policy of expressed breast milk are:

NICU nurses and midwives

Hospital administrators

Ministry of Health (MOH)

World Health Organization (WHO)

Universities (Academic programs)

Jordanian Nursing Council (JNC) and Jordanian Nurses and Midwives Council (JNMC)

Infection control units in the MOH hospitals.

#### **Issue statement**

What are the measures that can be taken by the stakeholders to assure the optimal safety when collecting and storing expressed breast milk?

## **6. POLICY OPTIONS**

### **Policy objectives:**

Policy objectives include the following:

- Discussing and analyzing EBM collection and storage in Jordanian hospitals
- Discussing national and worldwide strategies used to overcome EBM microbial contamination and misappropriation
- Establishing policies, laws and regulations that maintain continuous commitment to the applications of correct collection and storage procedures of EBM.

### **Policy options /alternatives**

After reviewing the literature, policy alternatives for resolving the issue of collection and storage of expressed breast milk in Jordan include the followings:

- Do nothing option (Status of quo): continue previous policies
- Change option I: Implementation of a Bar-coded label system; an electronically scanned bar-code label will be used for the identification of stored expressed milk.
- Change option II: implementation of the Hazard Analysis and Critical Control Points approach (HACCP) which is "a systematic preventive approach to identify, evaluate and control significant hazards to food safety" (Cossey, Juerissen, Thelissen, Vanhoole & Schuermans, 2017 p. 833).
- Change option III: Conduct a national nursing educational campaign to improve the Jordanians nurses` knowledge and practices regarding the collection and storage of expressed breast milk for hospitalized infants.

### **Apply evaluative criteria**

Based on Rodriquez-Garcia (2002) five criteria should be applied to the evaluation of interventions, which include the following:

- Relevance
- Progress
- Efficiency
- Effectiveness
- Impact

## **7. WEIGH THE OUTCOMES**

### **Analysis of option 1:**

To maintain safety and reduce the administration error of EBM in NICUs, bar-coded label system may be used. Bar-coded system replaced handwritten labels for identification of stored expressed breast milk with electronically scanned bar-coded labels. A physician's order initiates the process and generates the first bar-coded label. The parents received the bar coded labels from the nurse after the nurse verified the name and the date of birth. This system was implemented and evaluated in The Northern Westchester Neonatal Intensive Care Unit/Nursery Nursing Shared Governance council, the process was well received and the adherence goal for this initiative was 100%. The staffs were given education programs and the unit remained error free (Lane, Rosenberg, Mendoza & Delarosa, 2012). In the MOH, most of the hospitals are applying the electronic

medical records and use Hakeem system and most of the staffs are trained and had already working on this system. In addition to using the same system (bar code) for medication. Thus, it can be a feasible and efficient to apply this system in the NICUs in MOH and university hospitals.

#### Analysis of option 2:

Use the HACCP aimed at unsafe practices during the entire processing and storage process and as such differs from traditional final product testing. All steps are designed to limit the contamination of EBM by microorganisms and to prevent of multiplication. These steps are:

Step1: description of HACCP`s scope: from the expression of milk to the feeding of infants.

Step2: identify potential hazards for each process

Step 3: define control measures to eliminate or reduce the identified hazards to an acceptable level.

Step 4: establish monitoring system for each Critical Control Point (CCP).

This system approach includes measurable indicators for use in monitoring the most important aspects of expressed milk expression, transport, delivery, storage, and administration. In each step in the process, potential hazards, control measures, critical control points and possible adjustment are listed. This system is comprehensive and highly relevant for all the process of EBM from expression to administration, but it needs an interdisciplinary team and collaboration between parents, nurses, physicians, infections control and the administrators. In addition to that, it needs an education program and training for the staffs and this require a high cost relatively.

#### Analysis of option 3:

Conducting a national nursing educational campaign to increase the Jordanian nurses` knowledge and practices regarding EBM collection and storage is the last option. The educational campaign may require a higher cost than the previous options and may have less impact and effective outcomes to the overall process.

### 8. MAKE THE DECISION

After reviewing the literature and applying the evaluation criteria for each option, it is obvious that using the bar- coded label system is the most relevant, efficient, effective, progressive and has a high impact on the health of infants and their families.

**Table 1: Policy Analysis Scorecard: Collection and storage of expressed breast milk**

Evaluative Criteria	Alternatives		
	Bar-coded label system	Hazard Analysis and Critical Control Points approach (HACCP)	Nursing educational campaign about the collection and storage EBM
Relevance	+	++	+
Progress	+	++	+
Efficiency	+	—	—
Effectiveness	++	++	+
Impact	++	+	+
	7+	7+/1-	4+/1-
Score for each alternative	7	6	3

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